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Self-consistent wormhole solutions of semiclassical gravity

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Abstract

We present the first results of a self-consistent solution of the semiclassical Einstein field equations corresponding to a Lorentzian wormhole coupled to a quantum scalar field. The specific solution presented here represents a wormhole connecting two asymptotically spatially flat regions. In general, the diameter of the wormhole throat, in units of the Planck length, can be arbitrarily large, depending on the values of the scalar coupling ξ and the boundary values for the shape and redshift functions. In all cases we have considered, there is a fine structure in the form of Planck-scale oscillations or ripples superimposed on the solutions.